Claims

We claim:

1. A method for performing optical signal and beam distribution in a heterodyne interferometer, the method comprising:

providing a planar lightwave circuit comprising a plurality of waveguide optical transmission elements and an input coupler and an output coupler arranged along the optical transmission elements;

matching optical pathlengths of the transmission elements between the input coupler and the output coupler to compensate for thermal effects; and

determining reference and measurement optical phases employing the input coupler and the output coupler.

2. The method according to claim 1, wherein the input coupler and the output coupler comprise optical waveguide directional couplers.

3. The method according to claim 1, wherein the input coupler and the output coupler comprise multimode interference (MMI) devices.

4. The method according to claim 1, wherein the input couplers comprise waveguide Y-branch couplers.

5. The method according to claim 1, wherein the output coupler comprises a waveguide directional coupler with a 50:50 splitting ratio.

6. The method according to claim 1, wherein the output directional couplers are operable to provide a differential output appropriate for balanced detection.

7. The method according to claim 1, wherein the output couplers comprise a 2x2 multimode interference device operable to provide a differential output appropriate for balanced detection.

8. The method according to claim 1, wherein the output coupler comprises a 2x1 combiner operable to provide a single ended output.

9. The method according to claim 1, further comprising:

utilizing at least one of the input coupler and the output coupler to split off a reference phase signal; and

selecting a coupling ratio for at least one of the input coupler and the output coupler to optimize a detected heterodyne output signal when unequal losses are encountered in either measurement optical paths or reference optical paths.

10. The method according to claim 1, further comprising:

fabricating the planar lightwave circuit in silica on silicon.

11. The method according to claim 10, further comprising:

fabricating the planar lightwave circuit in silica on silicon utilizing planar lightwave fabrication processes.

12. The method according to claim 1, further comprising:

fabricating the planar lightwave circuit in silica on quartz.

13. The method according to claim 1, further comprising:

fabricating the planar lightwave circuit from at least one of a polymer, a III-V semiconductor, silicon, and lithium niobate.

14. The method according to claim 1, further comprising:

achieving dimensional control of waveguide and device critical dimensions of the planar lightwave circuit utilizing microelectronic photolithographic techniques to provide the planar lightwave circuit.

15. The method according to claim 1, further comprising:

achieving dimensional control of matched planar lightwave circuit waveguide lengths utilizing microelectronic photolithographic techniques.

16. The method according to claim 1, further comprising:

designing crossings of the transmission elements for application specific required minimal crosstalk.

17. The method according to claim 1, further comprising:

fabricating selected mode polarization strippers at an input port and an output port of the planar lightwave circuit.

18. The method according to claim 17, further comprising:

positioning a metal layer above or below the planar lightwave circuit; and

inducing optical evanescent H-field currents in the metal to selectively strip a TM polarization mode off at the input and output ports.

19. A device operable to distribute optical signals and beams in a heterodyne interferometer, the device comprising:

a planar lightwave circuit comprising a plurality of waveguide optical transmission elements; and

an input coupler and an output coupler arranged along the optical transmission elements and operable to determine reference and measurement optical phases, wherein optical pathlengths of the optical transmission elements between the input coupler and the output coupler are matched to compensate for thermal effects.

20. The device according to claim 19, wherein the couplers comprise optical waveguide directional couplers.

21. The device according to claim 19, wherein the couplers comprise multimode

interference devices.

22. The device according to claim 19, wherein the couplers comprise waveguide Y-branch couplers.

23. The device according to claim 19, wherein the output coupler comprises a waveguide directional coupler having a 50:50 splitting ratio.

24. The device according to claim 23, wherein the output coupler is operable to provide a differential output appropriate for balanced detection.

25. The device according to claim 20, wherein the output coupler is operable to provide a differential output appropriate for balanced detection.

26. The device according to claim 19, wherein the output coupler comprises a 2x2 multi-mode interference device operable to provide a differential output for balanced detection.

27. The device according to claim 19, wherein the output coupler comprises a 2x1 combiner operable to provide a single ended output.

29. The device according to claim 19, wherein at least one of the input coupler and the output coupler is operable to split off a reference phase signal.

30. The device according to claim 19, wherein at least one of the input coupler has a coupling ratio operable to optimize a detected heterodyne output signal when encountering unequal losses in measuring optical paths or reference optical paths.

31. The device according to claim 19, wherein the optical transmission elements are embedded in a silica layer.

32. The device according to claim 19, wherein the substrate is silicon.

33. The device according to claim 19, wherein the substrate is quartz.

34. The device according to claim 19, wherein the planar lightwave circuit comprises at least one of a polymer, a III-V semiconductor, silicon and lithium niobate.

35. The device according to claim 19, wherein the planar lightwave circuit further comprises:

crossings of the waveguide optical transmission elements, the waveguide crossings being operable for application specific required minimal crosstalk.

36. The device according to claim 19, further comprising:

selected mode polarization strippers arranged at an input port and an output port of the planar lightwave circuit.

37. The device according to claim 36, wherein the TM polarization mode is selectively stripped off at the input and output ports by the use of optical evanescent H-field induced currents in an appropriately positioned metal above or below the optical waveguide.